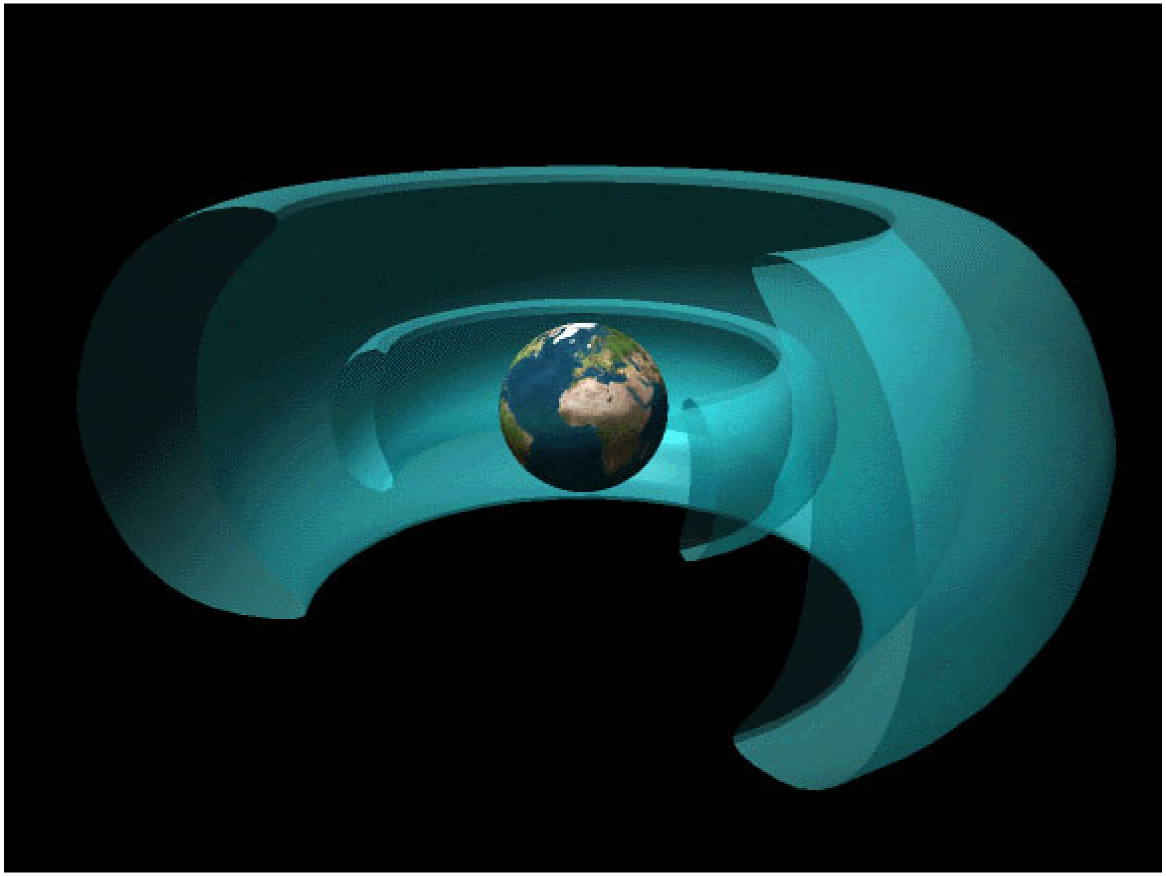
Radiation Belt Mappers



RBM Mission Goals and Objectives

As part of the LWS initiative, the RBM mission will result in an understanding of the origin and dynamics of the radiation belts and determine the temporal and spatial evolution of penetrating radiation during magnetic storms. It will address the needs of both science and user communities now and in the next decade and enable systematic long-term characterization of the radiation environment to capture extreme events.

- Specific science community needs include:
  - Coverage of full particle phase space distributions over local time and altitude
  - Electric and magnetic fields characterization over frequency domains of interest for understanding source, acceleration, transport, diffusion, and scattering mechanisms in the radiation belts
- Specific user community needs include:
  - Data products for specification and predictive models
  - Data products for real-time telemetry for the operations community

RBM Approach/Methodology

The approach and methodology for the RBM mission are to:

- Utilize current and near-term missions for targeted data analysis, development of models, procedures, and protocols
- Implement an array of spacecraft to provide primary data objectives
- Utilize flights-of-opportunity targeting specialized science objectives such as continuing characterization of extreme events
- Enable onboard real-time data products

RBM Mission Description

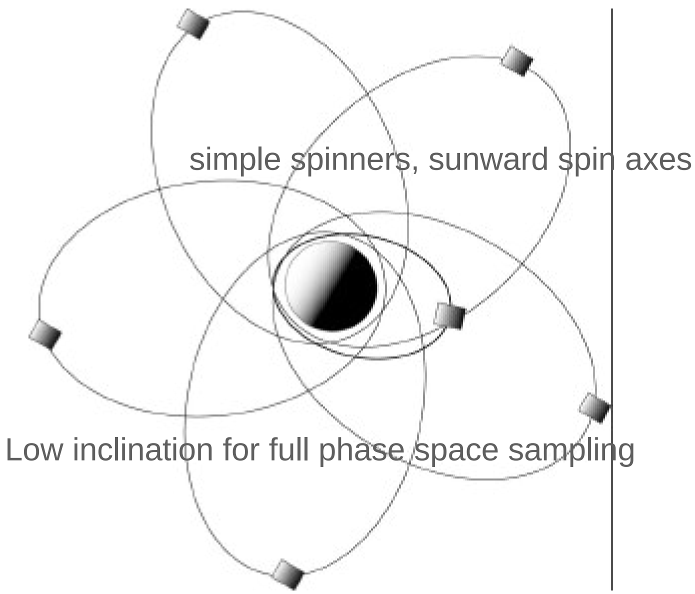
The RBM mission will employ an array of small satellites in low-inclination orbits to provide a large-scale, time-dependent characterization of particles and fields in the Earth's inner magnetosphere. The orbit, spacecraft, and instrument complement for each spacecraft is determined by analysis of physical parameters characterizing user and science requirements and priorities for the radiation belts. Key requirements include:

Particles - protons and electrons

- High energy (1 MeV - maximum required)
- Mid energy (30 keV - 1 MeV)
- Low energy (<30 keV)
- Thermal plasma (<100 eV)
- Energetic ion composition

Fields and Waves

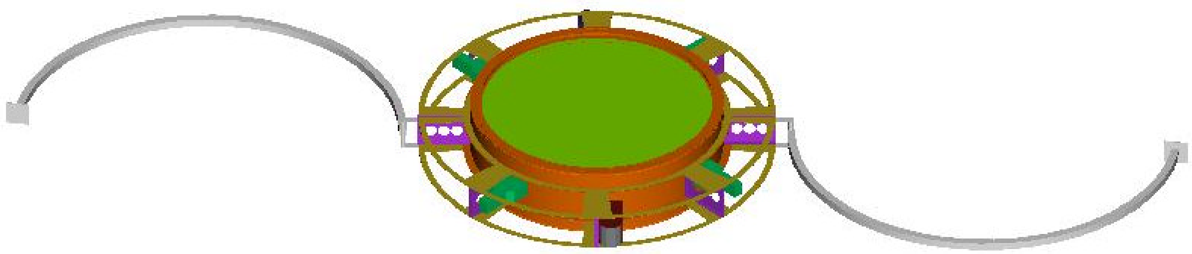
- Magnetic field
- Electric field
- Ultra-long frequency/very-long frequency (ULF/VLF) waves



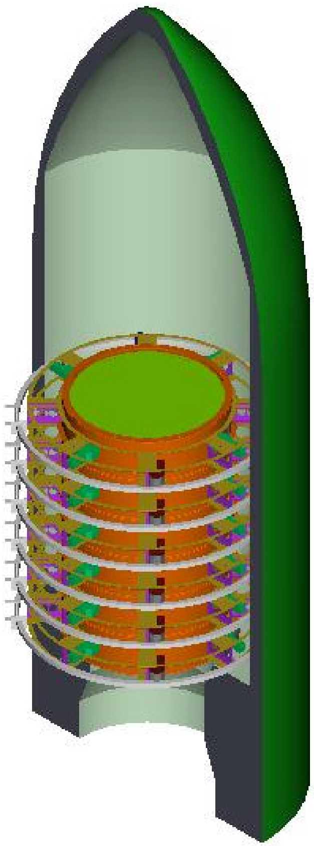
Candidate configuration

RBM Conceptual Configuration

It is planned to launch the RBM spacecraft in a stacked configuration as shown in the illustration.



Spacecraft Deployed Configuration



Multiple Spacecraft in
Launch Vehicle Fairing

RBM Mission Characteristics

- Launch from Eastern Range in 2008
- Medium class launch vehicle
- 2-year mission design life with 5-year goal
- Desire up to seven spacecraft
- Up to six identical small spinning spacecraft (constellation) in 500 km x $6.5R_E$ petal orbits
- One small spinning spacecraft in 500 km x $2.5R_E$ orbit
- Seven or eight in-situ instruments per spacecraft with high Technology Readiness Level (TRL)
- Three ground stations for real-time data acquisition
- Innovative sensor development for lighter weight, high-energy particle measurements
- Low-impulse supplementary propulsion for periodic orbit trimming
- Simple spacecraft design to enable industry participation
- Onboard data processing to enable real-time transmission of user priority data products
- Rapid data-to-model assimilation